

Standardised feeding regimens: hope for reducing the risk of necrotising enterocolitis

S S Premji

A perspective on the paper by Patole and de Klerk¹

Necrotising enterocolitis (NEC), an acquired gastrointestinal disease in neonatal intensive care unit survivors, affects one to three infants per 1000 live births and is associated with significant mortality and morbidity.²⁻³ Although it has not been proven, many believe that, in premature infants, a precursor to NEC is feeding intolerance, specifically, prefeed gastric residuals or bile stained aspirates.⁴⁻⁶ These associated intestinal signs of NEC may also reflect a delay in maturation of the neonate's motor activity such that they lack complete interdigestive cycles during fasting. As no biological markers exist to diagnose NEC, clinical wisdom guides decision making related to its diagnoses and management. Furthermore, there is a paucity of research identifying feeding practices, except for breast milk feeds, that offer the greatest potential benefit against developing NEC. Moreover, hormonal, anatomical, and functional limitations of low birthweight infants, the additive effects of critical illness, and intrauterine environmental factors—for example, antenatal glucocorticoids—complicate feeding decisions in this population of infants. Consequently, there is great variability in feeding orders for low birthweight infants.

A standardised feeding regimen (SFR) is one strategy to address the challenges of feeding low birthweight infants. Establishing such an SFR would require synthesising the available evidence⁷ and communicating the clinical wisdom from the experts, thereby promoting a more systematic approach to feeding low birthweight infants. A systematic review and meta-analysis of observational studies reporting the incidence of NEC “before” and “after” implementation of SFR undertaken by Patole and de Klerk¹ reported a pooled risk ratio of 0.13 (95% confidence interval 0.03 to 0.50). The reduced incidence of NEC after the introduction of SFRs was attributed to minimisation of variations in enteral feeding practices.¹ However, it is unclear what

degree of variation in practice will significantly contribute to the incidence of NEC. Alternatively, what measure of reduction in variation in practice resulting from the implementation of SFRs will significantly contribute to a decrease in the incidence of NEC?

In order for an SFR to attain the goal of preventing or minimising NEC, compliance or adherence to the regimen is imperative. The issue of compliance with the SFR may also contribute to the significant heterogeneity ($p < 0.001$) noted between studies included in the systematic review by Patole and de Klerk.¹ One must consider ethical conflict when addressing the issue of non-compliance. Uncertainty is reduced in SFRs through the prudent use of evidence from rigorous trials or, in the absence of such trials, expert clinical opinion. The intent is to minimise the art of medicine and promote the use of clinical science.⁸ The validity of the SFR will be limited if the evidence on which it is based is weak.⁹ In addition, SFRs are not intended to be prescriptive, and their use in clinical practice will ultimately require the practitioner's judgment. The consensus of experts, which has been the crux of the development of SFRs, may eliminate idiosyncratic judgments of single clinicians; however, it introduces value judgments—for example, choice made on the basis of safety or effectiveness—about what ought to be done for a condition.¹⁰ Understanding these ethical conflicts or dilemmas will help to facilitate implementation or revision of guidelines and increase the potential benefit to low birthweight infants. Future studies evaluating SFRs need to have a qualitative component that identifies and defines ethical issues, explains ethical judgments or behaviours, and analyses or appraises clinical decision making.

Patole and de Klerk¹ propose that clinical variation in practice determines risk of NEC. Although not explicitly stated, one can infer that this refers to variability in physician orders. However, nursing management of tube feeding is

also inconsistent and varies from nurse to nurse.¹¹ Each nurse uses their individual expertise to resolve problems related to regurgitation, abdominal distension, and residuals.¹² Hodges and Vincent¹³ have shown variability in the practice of withdrawing feeding and management of feeding residuals. As the success of any nutritional approach depends on neonatal nurses, who spend a significant amount of time feeding, and assessing infants before, during, and after feeds,¹¹ a better understanding of nursing practice related to tube feeding is required. This understanding will facilitate a unified systematic approach to nursing management of tube feeds based on the current state of scientific knowledge.

Patole and de Klerk¹ attribute the reduced incidence of NEC after the introduction of an SFR to an increased awareness leading to early detection and management of signs of “feeding intolerance”. However, there is no consensus in the literature with regard to the operational definition of feeding intolerance. In the scientific literature, prefeed gastric residual volumes, colour of gastric aspirates, abdominal distension, spitting up, presence of blood in stool, and apnoea and bradycardia are signs listed for feeding intolerance.^{6, 14-16} Researchers have tried to define feeding intolerance by quantifying volume of prefeeding gastric residuals considered to be significant; however, the volume considered significant varies across studies. The threshold of what is considered to be a significant volume of gastric residual appears to be increasing.¹⁷ The chances that clinicians will adopt SFRs decreases with an increase in uncertainty of the validity of the science behind them. A standardised approach to identifying feeding intolerance and predicting NEC will facilitate compliance with SFRs, as well as facilitate a more meaningful interpretation of studies that examine the relation between diet and gastrointestinal diseases such as NEC. One potential strategy is the development of decision rules that have been assessed for reliability and validity.

The process by which SFRs are shared and eventually adopted is a social process which influences the clinician's knowledge, attitudes, and behaviour.^{18, 19} Consequently it is not surprising that Patole and de Klerk¹ note that it is the process rather than the specific constituents that lead to improved outcomes. A Cochrane systematic review on guidelines in professions allied to medicine—for example, nursing, midwifery, and health visiting—identified 18 studies that provide evidence that guideline driven care can be effective in changing the process of care.²⁰

In conclusion, an SFR offers hope for reducing the risk of NEC by decreasing variability in practice. SFRs should address variability in both medical and nursing practice. Implementation strategies that comprise processes aimed to improve the clinician's compliance with the recommendations will determine the extent to which they are useful. It is imperative, however, that clinicians understand the values driving research, outcomes, and management issues. If clinicians lack this understanding, then ethical conflict or dilemmas could ensue which may impede the adoption of the SFR. In addition, SFRs may not be appropriate for all low birthweight infants, hence, clinicians need to exercise judgment otherwise they may compromise the infant's care. Future studies need to measure the relative effectiveness of the SFR. Emphasis on effectiveness will allow the researcher to evaluate the utility of the SFR in practice, process of care, quality of care, and patient/parent satisfaction.²¹

Arch Dis Child Fetal Neonatal Ed 2005;**90**:F192-F193.
doi: 10.1136/adc.2004.063198

Correspondence to: Dr Premji, University of Calgary, Faculty of Nursing, 2500 University Dr NW, Calgary, AB, Canada, T2N 1N4; premjis@ucalgary.ca

Competing interests: none declared

REFERENCES

- 1 **Patole S**, de Klerk N. Impact of standardised feeding regimens on incidence of neonatal necrotizing enterocolitis: a systematic review and meta analysis of observational studies. *Arch Dis Child Fetal Neonatal Ed* 2005;**90**:F147-51.
- 2 **Guthrie S**, Gordon P, Thomas V, *et al*. Necrotizing enterocolitis among neonates in the United States. *J Perinatol* 2003;**23**:278-85.
- 3 **Lee J**, Polin R. Treatment and prevention of necrotizing enterocolitis. *Semin Neonatal* 2003;**8**:449-59.
- 4 **Bell M**, Temberg J, Feigin R, *et al*. Neonatal necrotizing enterocolitis. Therapeutic decisions based upon clinical staging. *Ann Surg* 1978;**187**:1-7.
- 5 **Walsh M**, Kliegman R. Necrotizing enterocolitis: treatment based on staging criteria. *Pediatr Clin North Am* 1986;**33**:179-201.
- 6 **Mihatsch W**, von Schoenach P, Fahnenstich H, *et al*. The significance of gastric residuals in the early enteral feeding advancement of extremely low birth weight infants. *Pediatrics* 2002;**109**:457-9.
- 7 **Lewis S**. Paradox, process and perception: The role of organizations in clinical practice guidelines development. *CMAJ* 1995;**153**:1073-7.
- 8 **Jonsen A**, Siegler M, Winslade W. *Clinical ethics: a practical approach to ethical decisions in clinical medicine*, 5th ed. Toronto: McGraw-Hill, 2002.
- 9 **Hayward R**, Wilson M, Tunis S, *et al*. Users' guides to the medical literature. VIII. How to use clinical practice guidelines. A. Are the recommendations valid? *JAMA* 1995;**274**:570-4.
- 10 **Battista R**, Hodge M, Vineis P. Medicine, practice and guidelines: the uneasy juncture of science and art. *J Clin Epidemiol* 1995;**48**:875-80.
- 11 **Premji S**, Paes B, Jacobson K, *et al*. Evidence-based feeding guidelines for very low-birth-weight infants. *Adv Neonat Care* 2002;**2**:5-18.
- 12 **Bragdon D**. A basis for the nursing management of feeding the premature infant. *J Obstet Gynecol Neonatal Nurs* 1983;**12**:51S-7S.
- 13 **Hodges C**, Vincent P. Why do NICU nurses not refeed gastric residuals prior to feeding by gavage? *Neonatal Netw* 1993;**12**:37-40.
- 14 **Rayyis S**, Ambalavanan N, Wright L, *et al*. Randomized trial of "slow" versus "fast" feed advances on the incidence of necrotizing enterocolitis in very low birth weight infants. *J Pediatr* 1999;**134**:293-7.
- 15 **Dollberg S**, Kuint J, Mazkereth R, *et al*. Feeding tolerance in preterm infants: randomized trial of bolus and continuous feeding. *J Am Coll Nutr* 2000;**19**:797-800.
- 16 **Akintorin S**, Kamat M, Pildes R, *et al*. A prospective randomized trial of feeding methods in very low birth weight infants. *Pediatrics* 1997;**100**:e4.
- 17 **Premji S**, Chessel L, Paes B, *et al*. A matched cohort study of feeding practice guidelines for infants weighing less than 1,500 g. *Adv Neonat Care* 2002;**2**:27-36.
- 18 **Cabana M**, Rand C, Powe N, *et al*. Why don't physicians follow clinical practice guidelines? *JAMA* 1999;**282**:1458-65.
- 19 **Mittman B**, Tonesk X, Jacobson P. Implementing clinical practice guidelines: social influence strategies and practitioner behavior change. *QRB Qual Rev Bull* 1992;**18**:413-22.
- 20 **Thomas L**, Cullum N, McColl E, *et al*. Guidelines in professions allied to medicine. *Cochrane Library*. Issue 3. Oxford: Update Software, 2004.
- 21 **Johanson J**. Outcomes research, practice guidelines, and disease management in clinical gastroenterology. *J Clin Gastroenterol* 1998;**27**:306-11.

Encephalopathy

Prevalence, causes, and outcome at 2 years of age of newborn encephalopathy

N Marlow, H Budge

A commentary on the article by Pierrat *et al*

Regional population based studies of infants who suffer from intrapartum hypoxia are rare, and Pierrat and colleagues are to be congratulated on such a study. As always it is easy to criticise such studies because case definition is so difficult, and, without accurate imaging and detailed case evaluation, it is difficult to be sure that a neonatal encephalopathy is due to hypoxia. The definition of perinatal hypoxia-ischaemia that they have used might be viewed as inclusive and is at variance with the template for intrapartum causation for cerebral palsy, which

requires evidence of an intrapartum event.¹ Without detailed evaluation of each case, it is difficult to be certain of the timing of the cause.

In the literature, most outcome evaluations of neonatal populations have studied very preterm infants, and there have been only a few population studies of neonatal encephalopathy. The birth prevalence of encephalopathy reported in this paper is in keeping with the results of the Trent Neonatal survey (Department of Health Sciences, University of Leicester, Leicester LE1 6TP, UK), which has prospectively

collected well validated information for over 10 years. This study includes all children with seizures as a pragmatic definition of encephalopathy and reports population rates in the Trent Region of the United Kingdom varying from 1.3 to 1.4 per 1000 live births between 1999 and 2003. Neither study approaches the reported prevalence from Western Australia,² but the latter was also a deliberately inclusive study. All three studies use different definitions.

In trying to understand the prevalence and outcome of intrapartum hypoxia, this study shows the need for accurate and clear case definition and for the role of obstetric factors, routine collection of cord blood gas data, and neonatal imaging with magnetic resonance imaging in teasing out the cause. All neonatal services should collect this information. The best definition of encephalopathy remains the three categories described first by Sarnat and Sarnat³ with or without the presence of seizures. A consensus over definition of encephalopathy is perhaps required in situations where detailed neurological assessment has not been carried out and for epidemiological purposes, although